An Analysis of Z-Scores & Performance: Manufacturing Companies in Hong Kong

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ABSTRACT— ***Hong Kong is a key leading economy in the Asia Pacific region. This study examines the relationship between the financial health, as measured by the Altman Z-Score, and corporate performance, as measured by the Return on Equity (ROE), of listed manufacturing companies in this market. A linear regression has been conducted between these variables to determine the magnitude and direction of their relationships. The trends of Z-Scores over a five-year period have also been analysed. The analysis covers the period from 2013 to 2017 (inclusive) and yields a statistically positive correlation between ROE and the Z-Score for the market. Hong Kong registered relatively healthy mean and median Z-Scores. These findings further support the strong economic position of this market as an Asian giant.***

Keywords— financial health, corporate performance, manufacturing, altman z-score, roe, hong kong, hkse, sehk

1. INTRODUCTION

1.1 Introducing the Research Topic

The Asia Pacific region has experienced dramatic economic growth in recent years (IMF, 2017). While growth is essential, the sustainability of organizations is also dependent on its financial health. A notable important economy that is riding on these economic growth trends is Hong Kong. This economy is an important business hub in the Asia Pacific economic ecosystem.

The purpose of this paper is to examine the relationship between corporate financial health, as measured by the Altman Z-Score (Altman, 1968), and corporate performance, as measured by the Return on Equity (ROE), of listed manufacturing companies on the Hong Kong Stock Exchange (HKSE or SEHK) which is the largest exchange in Hong Kong. More specifically, we seek to determine whether financial health is a determinant of corporate performance in this market.

1.2 Motivation & Contribution

Corporate performance is important but sound financial health is also needed to ensure sustainability. The motivation of this study is to determine whether well performing companies are financially healthy in this market. This study extends the work by Meric, Lents, Li and Meric (2014) on the Asia Pacific markets by providing further understanding into the financial health, as measured by the Z-Score, and corporate performance, as measured by ROE.

An important contribution is to provide empirical insights about this market in relation to its firms' Z-Score and ROE over a period of five years, i.e. 2013 to 2017 (inclusive). This study also provides an examination of the trends of Z-Scores over time (mean, median and standard deviation). We believe this study would contribute to the further understanding of this market by key stakeholders, such as investors.

With Asia's growing economic importance, the study hopes to serve as catalyst for similar research on other Asian economies. Additionally, a further motivation has been to extend and update the authors' previous works on this subject (Foo, 2015).

1.3 Literature Review

Corporate financial health has been widely studied on countries in the Asia Pacific. These studies include Hong Kong and Singapore (Foo, 2015), China (Wang and Campbell, 2010A and 2010B), India (Pradhan, 2014), Sri Lanka (Gunathilaka, 2014), and Malaysia (Thai, Goh, Teh, Wong and Ong, 2014). The Altman Z-Score (Altman, 1968) was the preferred measure of financial health in these studies.

Unlike the prior model by Beaver (Beaver, 1966) which examined financial ratios separately, Edward I. Altman, created the Altman Z-Score (Altman, 1968) which combined a variety of financial ratios into a single score that reflected the likelihood of a firm going into bankruptcy using multiple discriminant analysis (MDA).

The model showed high predictive power on companies facing financial distress, as measured by the Z-Score. The literature on statistical models for bankruptcy prediction is wide-ranging and continues to expand. For example, E. I. Altman, in his lecture (Altman, 2007) quotes 12 new variants of his models. Other studies on financial health that followed the Z-Score Model include Blum (1974), Deakin (1977), Beynon and Peel (2001), Neophytou et al. (2001) and Chung et al. (2008). Some researchers also used logit regression techniques (Ohlson, 1980), recursive partitioning analysis (Frydman et al., 1985) and artificial neural network models (Trippi and Turban, 1996). Nevertheless, Perez (2006) highlighted that MDA is still one of the most popular approaches used for bankruptcy prediction (Agarwal and Taffler, 2007).

Furthermore, Aziz and Dar (2006) appraised 89 studies on prediction of bankruptcy between 1968 and 2003 and found that the multi-variable models, such as the Z-Score model, were the most widely accepted. Additionally, a significant body of research (e.g. Altman and McGough, 1974; Altman, 1982; Levitan and Knoblett, 1985; Koh and Killough, 1990) supports the reliability of the Z-Score for the prediction of financial distress. Recently, Sherbo and Smith's (2013) study concluded that the Z-Score model has stood the test of time and is still highly applicable in today's business environment. In view of the above merits, this study adopts the Altman Z-Score as our measure of financial health. The formula for the model is discussed in the Methodology and Data section of this paper.

There have been numerous measures of corporate performance and profitability. However, the Return on Equity (ROE) has proven to be a consistently robust and popular measure of corporate performance (Chen (1997), Chen (2005), Damodaran (2007), Hagel et al. (2010), and Zhao (2013)). ROE is defined as the income produced on equity capital and is calculated by dividing net income by the book value of shareholder's equity (Damodaran, 2007). It is a widely used accounting measure of companies' financial performance in making investment decisions (Stowe, Robinson, Pinto & McLeavey, 2002). In view of this body of literature, we adopt ROE as our measure of corporate performance in this study.

A key comparative study done between Asia Pacific countries was by Meric, Lentz, Li and Meric (2014). This study examined the financial characteristics (liquidity, turnover ratios, financial leverage, profitability and growth) of manufacturing firms using multivariate analysis. Although it provided useful insights into these markets, this study did not explore the relationship between their corporate performance and their financial health.

A recent study by Tandiontong and Mathius (2017), found the partial correlation between stock returns and Altman Z-Score, beta stocks and inflation in the Indonesian stock market. Another recent study by Saji (2018) showed that the Z-scores of firms carry sufficient information content that forewarns their stock market failures two to five years in advance (Indian realty sector).

1.4 Research Question & Hypothesis

The research question for study is: do higher performing listed manufacturing companies (as measured by the ROE – dependent variable) in the market also exhibit higher financial health (as measured by the Altman Z-Score – independent variable)? The Null Hypothesis is that there is no significant statistical relationship between firm performance and financial health in each market. Whereas, the Alternative Hypothesis is that there is a significant statistical relationship between firm performance and financial health.

2. METHOD

2.1 Methodology & Data

This study adopts the widely used Altman (1968) Z-Score model (Wang and Campbell, 2010A and 2010B; Pradhan, 2014; Gunathilaka, 2014; Thai, Goh, Teh, Wong and Ong, 2014) to determine financial health. The Z-Score formula is provided in Figure 1.

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Equation for Altman's Z-Score Model (1968):

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1X_5$$

X_1 = Working Capital / Total Assets

X_2 = Retained Earnings / Total Assets

X_3 = Earnings Before Interest & Tax (EBIT) / Total Assets

X_4 = Market Capitalisation / Total Liabilities

X_5 = Sales / Total Assets

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Figure 1: Equation for Altman's Z-Score Model (1968).

A linear regression was run using the relevant data with this formula: $Y = \beta1Z1 + C$ where Y is the dependent variable, which is the Return on Equity (ROE); β1 is the regression coefficient, which provides an indication of the direction and magnitude of the relationship; Z1 is the independent variable which is the Altman Z-Score and C is the constant.

The scope of the regression covers the period from 2013 to 2017. The financial statement data used was extracted from the Thomson Reuters DataStream database. Records of all firms listed on the two exchanges that had available error-free information were utilized in the regression analysis. Furthermore, the top and bottom 1% of the outliers were removed for the regression analysis.

3. RESULTS

3.1 Descriptive Analysis

Table 1: Mean and Median Z-Scores – Hong Kong (HKSE).

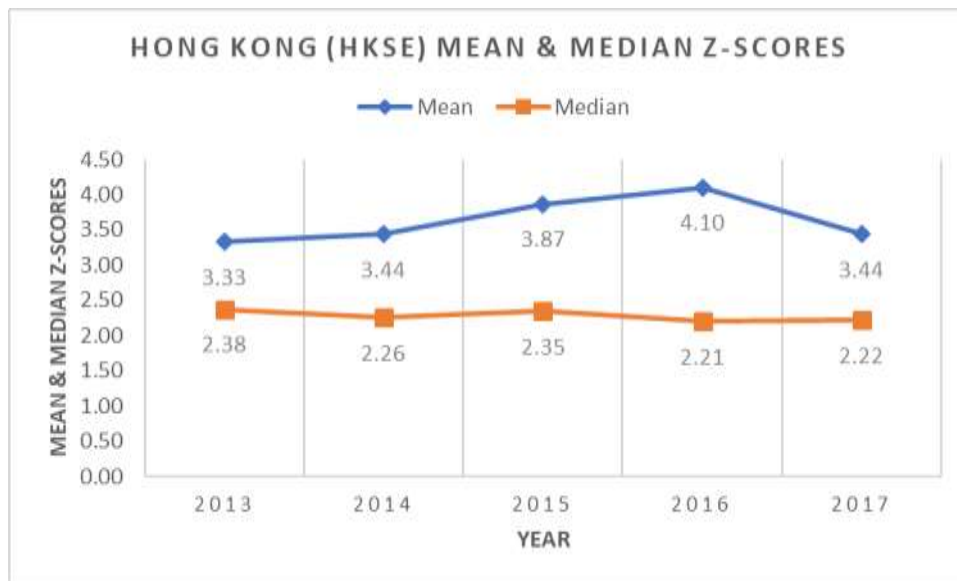| Year	2013	2014	2015	2016	2017
Median	2.38	2.26	2.35	2.21	2.22
Mean	3.33	3.44	3.87	4.10	3.44
Std. Dev.	5.53	7.58	7.78	16.50	7.70

Figure 2: Mean and Median Z-Score Trends for Hong Kong (HKSE).

Table 1 above presents the mean and median Z-Scores (with standard deviations) for the market and Figure 2 above presents the respective trends for the five-year period from 2013 to 2017.

As per Altman (1968), a Z-Score that is greater than 2.99 indicates strong financial health, as shown in green in the tables. Whereas, a Z-Score that is lower than 1.81 indicates poor financial health.

The overall means and median Z-Scores are in the moderate-to-healthy range throughout the period. This indicates that generally, the market is financially healthy, which is also aligned with its economic standings in the Asia Pacific region.

The median Z-Scores are considerably lower in magnitude than their mean Z-Scores throughout the period. This could be explained by the large variations in the size and type of firms. The median Z-Scores stayed relatively constant from 2013 to 2017, whilst the means rose till 2016 after which they fell until 2017.

Additionally, the market's mean Z-Scores have remained within the range of 3.33 to 4.10 and its median scores ranged from 2.21 to 2.38. During the five-year period, the mean Z-Scores exceeded the higher 2.99 benchmark in all five years. This presents a strong financial health outlook for the market.

3.2 Regression Analysis

Table 2: Statistical Regression Outputs - Hong Kong (HKSE).

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Z-Scores	1.5420	0.6774	2.2761	0.0229	0.2137	2.8702

A total of 3,676 observations have been used for the regression of firms in the HKSE (see Table 2). Based on these observations, it has a regression coefficient of 1.542 (rounded). The standard error is close enough to zero, at 0.677, whilst the t-statistic is significant and positive at 2.2761 and the p-value is equal to 0.023, supporting the reliability of the regression output. This result confirms the Alternative Hypothesis by showing a positive (direction) and significant (magnitude) relationship between ROE, the dependent variable (representing corporate performance), and Z-Score, the independent variable (representing financial health).

Overall, these results show that there is indeed a statistically significant and positive relationship between firm performance and financial health in the stock exchange. These strong positive and significant relationships between corporate performance and financial health may be construed as a positive signal for business stakeholders such as investors in this market.

4. DISCUSSION

4.1 Limitations

A limitation of this study is that it focuses on listed manufacturing corporations, and not on other industries. This is because we would like to align our approach with the original Altman (1968) Z-Score Model. The focus of this paper is to explore the relationships of financial health and corporate performance in the specific contexts of the chosen market.

4.2 Future Research

For future research, the proposed methodology can be applied to analyse the relationship between financial health and corporate performance in other markets across Asia and beyond. Other industries can be included to enhance the breadth and depth of the study. Furthermore, other variables can also be examined, and their relationships analysed.

4.3 Conclusion

We set out to explore and analyse the relationship between financial health, as measured by the Altman (1968) Z-Score, and firm performance, as measured by Return on Equity (ROE) ratios, of manufacturing companies listed in Hong Kong's HKSE. We found that there was a statistically significant and positive relationship between Return on Equity (ROE) and Altman Z-Scores in the market. Furthermore, in our descriptive analysis, we observed generally moderate-to-healthy mean and median Z-Scores in the market and similar mean and median Z-Score trends over the period. These relationships may be construed as a positive assurance for stakeholders in this market, such as investors.

From an academic contribution standpoint, this study provides an updated empirical insight into the relationship between financial health and financial performance of listed companies in Hong Kong using recent data from 2013 to 2017. More importantly, with the growing importance of Hong Kong in the global economic landscape, key stakeholders can gain further understanding and assurance on the state of the market's firms' current financial health and performance.

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